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01.30	Physics literature and publications	04.90	Other topics in relativity and gravitation
01.30B	<i>Publications of lectures (advanced institutes, summer schools, etc.)</i>	05.00	STATISTICAL PHYSICS AND THERMODYNAMICS
01.30C	<i>Conference proceedings</i>	05.20	Statistical mechanics
01.30E	<i>Monographs and collections</i>	05.30	Quantum statistical mechanics
01.30K	<i>Handbooks and dictionaries</i>	05.40	Fluctuation phenomena, random processes, and Brownian motion
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01.30N	<i>Textbooks</i>	05.50	Lattice theory and statistics; Ising problems
01.30Q	<i>Reports, dissertations, theses</i>	05.60	Transport processes: theory
01.30R	<i>Reviews and tutorial papers; resource letters</i>	05.70	Thermodynamics
01.30T	<i>Bibliographies</i>	05.90	Other topics in statistical physics and thermodynamics
01.40	Education	06.00	MEASUREMENT SCIENCE, GENERAL LABORATORY TECHNIQUES, AND INSTRUMENTATION SYSTEMS
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01.55	General physics	06.20D	<i>Measurement and error theory</i>
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01.75	Science and society	06.30	Measurement of basic variables
01.90	Other topics of general interest	06.30C	<i>Spatial variables measurement</i>
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02.60	Numerical approximation and analysis	06.70	General instrumentation
02.70	Computational techniques	06.90	Other topics in measurement science, general laboratory techniques and instrumentation systems
02.90	Other topics in mathematical methods in physics	07.00	SPECIFIC INSTRUMENTATION AND TECHNIQUES OF GENERAL USE IN PHYSICS
03.00	CLASSICAL AND QUANTUM PHYSICS; MECHANICS AND FIELDS	07.10	Mechanical instruments and measurement methods
03.20	Classical mechanics of discrete systems; general mathematical aspects	07.20	Thermal instruments and techniques
03.30	Special relativity	07.20D	<i>Thermometry</i>
03.40	Classical mechanics of continuous media: general mathematical aspects	07.20F	<i>Calorimetry</i>
03.40D	<i>Mathematical theory of elasticity</i>	07.20H	<i>Furnaces</i>
03.40G	<i>Fluid dynamics: general mathematical aspects</i>	07.20K	<i>High-temperature techniques and instrumentation; pyrometry</i>
03.40K	<i>Waves and wave propagation: general mathematical aspects</i>	07.20M	<i>Cryogenics</i>
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04.00	RELATIVITY AND GRAVITATION	07.35	High pressure production and techniques
04.20	General relativity	07.50	Electrical instruments and techniques
04.30	Gravitational waves and radiation: theory	07.55	Magnetic instruments and techniques
04.40	Continuous media; electromagnetic and other mixed gravitational systems	07.58	Magnetic resonance spectrometers, auxiliary instruments, and techniques
04.50	Unified field theories and other theories of gravitation	07.60	Optical instruments and techniques
		07.60D	<i>Photometry and radiometry</i>

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- 07.60F *Polarimetry and ellipsometry*
 07.60H *Refractometry and reflectometry*
 07.60L *Interferometry*
 07.60P *Optical microscopy*
 07.62 Detection of radiation (bolometers, photoelectric cells, i.r. and submillimetre wave detection)
 07.65 Optical spectroscopy and spectrometers
 07.65E *UV and visible spectroscopy and spectrometers*
 07.65G *IR spectroscopy and spectrometers*
 07.68 Photography, photographic instruments and techniques
 07.75 Mass spectrometers and mass spectrometry techniques
 07.77 Particle beam production and handling; targets
 07.80 Electron and ion microscopes and techniques
 07.85 X-ray, gamma-ray instruments and techniques
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- 10.00 **THE PHYSICS OF ELEMENTARY PARTICLES AND FIELDS**
- 11.00 **GENERAL THEORY OF FIELDS AND PARTICLES**
 11.10 Field theory
 11.17 Theories of strings and other extended objects
 11.20 S-matrix theory
 11.30 Symmetry and conservation laws
 11.40 Currents and their properties
 11.50 Dispersion relations and sum rules
 11.60 Complex angular momentum; Regge formalism
 11.80 Relativistic scattering theory
 11.90 Other topics in general field and particle theory
- 12.00 **SPECIFIC THEORIES AND INTERACTION MODELS; PARTICLE SYSTEMATICS**
 12.10 Unified field theories and models
 12.20 Models of electromagnetic interactions
 12.20D *Specific calculations and limits of quantum electrodynamics*
 12.20F *Experimental tests of quantum electrodynamics*
 12.25 Models for gravitational interactions
 12.30 Models of weak interactions
 12.35 Composite models of particles
 12.35C *General properties of quantum chromodynamics (dynamics, confinement, etc.)*
 12.35E *Applications of quantum chromodynamics to particle properties and reactions*
 12.35H *Phenomenological composite models of particle structure and reactions (partons, bags, etc.)*
 12.35K *Other composite models*
 12.40 Models of strong interactions
 12.40E *Statistical models*
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 12.40H *Duality and dual models*
 12.40K *Hadron classification schemes*
 12.40M *Complex angular momentum plane; Regge poles and cuts (Reggeons)*
 12.40P *Absorptive, optical, and eikonal models*
 12.40Q *Potential models*
 12.40R *Peripheral models (one or more particle exchange)*
 12.40S *Multiperipheral and multi-Regge models*
 12.40V *Vector-meson dominance*
 12.70 Hadron mass formulas
 12.90 Miscellaneous theoretical ideas and models
- 13.00 **SPECIFIC REACTIONS AND PHENOMENOLOGY**
 13.10 Weak and electromagnetic interactions of leptons
 13.15 Neutrino interactions
 13.20 Leptonic and semileptonic decays of mesons
 13.25 Hadronic decays of mesons
 13.30 Decays of baryons
 13.35 Decays of leptons
 13.38 Decays of intermediate bosons
 13.40 Electromagnetic processes and properties
 13.40D *Electromagnetic mass differences*
 13.40F *Electromagnetic form factors; electric and magnetic moments*
 13.40H *Electromagnetic decays*
 13.40K *Electromagnetic corrections to strong and weak interaction processes*
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 13.60H *Total and inclusive cross sections*
 13.60K *Meson production*
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 13.65 Hadron production by electron-positron collisions
 13.75 Hadron-induced low- and immediate-energy reactions and scattering, energy ≤ 10 GeV
 13.75C *Nucleon-nucleon interactions, including antinucleon, deuteron, etc. (energy ≤ 10 GeV)*
 13.75E *Hyperon-nucleon interactions (energy ≤ 10 GeV)*
 13.75G *Pion-baryon interactions (energy ≤ 10 GeV)*
 13.75J *Kaon-baryon interactions (energy ≤ 10 GeV)*
 13.75L *Meson-meson interactions (energy ≤ 10 GeV)*
 13.85 Hadron-induced high- and super-high-energy interactions, energy > 10 GeV
 13.85D *Elastic scattering (energy ≤ 10 GeV)*
 13.85F *Inelastic scattering, two-particle final states (energy > 10 GeV)*
 13.85H *Inelastic scattering, many-particle final states (energy > 10 GeV)*
 13.85K *Inclusive reactions, including total cross sections (energy > 10 GeV)*
 13.85M *Cosmic ray interactions*
 13.88 Polarization in interactions and scattering
 13.90 Other topics in specific reactions and phenomenology of elementary particles
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 14.20 Baryons and baryon resonances
 14.40 Mesons and meson resonances
 14.60 Leptons
 14.80 Other and hypothetical particles
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- 21.00 **NUCLEAR STRUCTURE**
 21.10 General and average properties of nuclei; properties of nuclear energy levels
 21.10D *Binding energy and masses*
 21.10F *Shape, charge, radius, and form factors*
 21.10H *Spin, parity, and isobaric spin*
 21.10J *Spectroscopic factors*
 21.10K *Electromagnetic moments*
 21.10M *Level density and structure*
 21.30 Nuclear forces
 21.40 Few-nucleon systems
 21.60 Nuclear-structure models and methods

- 21.60C *Shell model*
- 21.60E *Collective models*
- 21.60F *Models based on group theory*
- 21.60G *Cluster models*
- 21.60J *Hartree-Fock and random-phase approximations*
- 21.65 Nuclear matter
- 21.80 Hypernuclei
- 21.90 Other topics in nuclear structure

- 23.00 RADIOACTIVITY AND ELECTROMAGNETIC TRANSITIONS
- 23.20 Electromagnetic transitions
- 23.20C *Lifetimes and transition probabilities*
- 23.20N *Internal conversion and extranuclear effects*
- 23.40 Beta decay; electron and muon capture
- 23.60 Alpha decay
- 23.90 Other topics in nuclear decay and radioactivity

- 24.00 NUCLEAR REACTIONS AND SCATTERING: GENERAL
- 24.10 Nuclear reactions and scattering models and methods
- 24.10H *Optical and diffraction models*
- 24.30 Resonance reactions and scattering
- 24.50 Direct reactions
- 24.60 Statistical theory and fluctuations
- 24.70 Polarization in reactions and scattering
- 24.75 General properties of fission
- 24.90 Other topics in nuclear reactions and scattering, general

- 25.00 NUCLEAR REACTIONS AND SCATTERING: SPECIFIC REACTIONS
- 25.10 Nuclear reactions and scattering involving few-nucleon systems
- 25.20 Photonuclear reactions and photon scattering
- 25.30 Lepton-induced reactions and scattering
- 25.40 Nucleon-induced reactions and scattering
- 25.50 ^2H - and ^3H -induced reactions and scattering
- 25.60 ^3He - and ^4He -induced reactions and scattering
- 25.70 Heavy ion induced reactions and scattering
- 25.80 Meson- and hyperon-induced reactions and scattering
- 25.85 Fission reactions
- 25.88 Fusion reactions
- 25.90 Other topics in nuclear reactions and scattering; specific reactions

- 27.00 PROPERTIES OF SPECIFIC NUCLEI LISTED BY MASS RANGES
- 27.10 $A \leq 5$
- 27.20 $6 \leq A \leq 19$
- 27.30 $20 \leq A \leq 38$
- 27.40 $39 \leq A \leq 58$
- 27.50 $59 \leq A \leq 89$
- 27.60 $90 \leq A \leq 149$
- 27.70 $150 \leq A \leq 189$
- 27.80 $190 \leq A \leq 219$
- 27.90 $220 \leq A$

- 28.00 NUCLEAR ENGINEERING AND NUCLEAR POWER STUDIES
- 28.20 Neutron physics
- 28.41 Fission reactor theory and design
- 28.42 Fission reactor materials
- 28.42H *Fuel production and reprocessing*
- 28.43 Fission reactor operation
- 28.44 Fission reactor protection systems, safety and accidents
- 28.46 Nuclear materials safeguards
- 28.47 Fission reactor decommissioning
- 28.50 Fission reactor types and applications
- 28.52 Fusion reactors
- 28.58 Integrated reactor systems
- 28.70 Nuclear explosions
- 28.75 Radioactive waste, transportation, disposal, storage, treatment
- 28.80 Radiation technology, including shielding
- 28.90 Other topics in nuclear engineering and nuclear power studies

- 29.00 EXPERIMENTAL METHODS AND INSTRUMENTATION FOR ELEMENTARY-PARTICLE AND NUCLEAR PHYSICS
- 29.10 Preacceleration (injection)
- 29.15 Electrostatic and linear particle accelerators
- 29.20 Cyclic accelerators and storage facilities
- 29.25 Particle sources and targets, preparation and technology
- 29.30 Radiation spectrometers and spectroscopic techniques
- 29.40 Radiation detectors
- 29.60 Counting circuits and nuclear electronics
- 29.70 Radiation measurement, detection and counting
- 29.75 Polarization analysis
- 29.80 Nuclear information processing
- 29.90 Other topics in high-energy and nuclear experimental methods and instrumentation

- 30.00 ATOMIC AND MOLECULAR PHYSICS
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- 31.15 General mathematical and computational developments
- 31.20 Specific calculations and results
- 31.20D *Complete ab initio calculations (exact or nearly exact calculations on small species)*
- 31.20E *Ab initio LCAO and GO SCF calculations*
- 31.20G *Other accurate, or nearly ab initio calculations (DIM method, SAMO method, etc.)*
- 31.20H *Xalpha methods*
- 31.20J *Local density approximation*
- 31.20L *Statistical model calculations (Thomas-Fermi and Thomas-Fermi-Dirac models)*
- 31.20N *Semi-empirical NDO calculations (CNDO, INDO, MINDO, PCIO methods, etc.)*
- 31.20P *Other semi-empirical calculations (Hückel, generalized Hückel, PPP methods, etc.)*
- 31.20R *Valence bond calculations (ab initio or not)*
- 31.20T *Electron correlation and CI calculations*
- 31.20W *Empirical methods (nonquantum methods for conformations)*
- 31.30 Electronic structure, corrections and effects of interactions
- 31.30G *Hyperfine interactions and isotope effects*
- 31.30J *Radiative and relativistic effects*
- 31.30L *Environmental and solvent effects*
- 31.30N *Molecular solids*
- 31.50 Excited states
- 31.90 Other topics in the theory of atoms and molecules

- 32.00 ATOMIC SPECTRA AND INTERACTIONS WITH PHOTONS
- 32.20 Atomic spectra grouped by wavelength ranges

- 32.20D *Radiofrequency and microwave spectra*
 32.20F *Infrared and Raman spectra*
 32.30J *Visible and ultraviolet spectra*
 32.20R *X-ray spectra*
 32.40 Magnetic resonance spectra
 32.50 Fluorescence, phosphorescence; radiationless transitions
 32.50F *Fluorescence, phosphorescence*
 32.50H *Radiationless transitions*
 32.60 Magneto-optical and electro-optical spectra
 32.60S *Stark effect*
 32.60V *Zeeman effect*
 32.70 Spectral line shapes and intensities
 32.80 Photon interactions with atoms
 32.80B *Level crossing, optical pumping, population inversion*
 32.80D *Autoionization*
 32.80F *Photoionization, photodetachment, photoelectron spectra*
 32.80H *Auger effect and inner-shell ionization*
 32.80K *Multiphoton processes*
 32.80P *Optical cooling of atoms; trapping*
 32.90 Other topics in atomic spectra and interactions with photons
- 33.00 MOLECULAR SPECTRA AND INTERACTIONS WITH PHOTONS
 33.10 Calculation of molecular spectra
 33.20 Molecular spectra grouped by wavelength ranges
 33.20B *Radiofrequency and microwave spectra*
 33.20E *Infrared spectra*
 33.20F *Raman and Rayleigh spectra*
 33.20K *Visible spectra*
 33.20L *Ultraviolet spectra*
 33.20N *Vacuum ultraviolet spectra*
 33.20R *X-ray spectra*
 33.25 Nuclear magnetic resonance and relaxation; nuclear quadrupole resonance (NQR)
 33.30 Electron paramagnetic resonance and relaxation
 33.35 Double resonances and other multiple resonances
 33.35H *MODR and PMDR (microwave optical double resonance and phosphorescence microwave double resonance)*
 33.40 Mössbauer spectra
 33.45 Magneto-optical and electro-optical spectra; dichroism
 33.45B *Zeeman and Stark effects*
 33.45C *Magnetic circular dichroism*
 33.50 Fluorescence, phosphorescence; radiationless transitions (intersystem crossing, internal conversion)
 33.65 Photoelectron spectra
 33.70 Intensities and shapes of molecular spectral lines and bands
 33.80 Photon interactions with molecules
 33.80B *Level crossing and optical pumping*
 33.80E *Autoionization, photoionization, and photodetachment*
 33.80G *Diffuse spectra; predissociation, photodissociation*
 33.80K *Multiphoton processes*
 33.80P *Optical cooling of molecules; trapping*
 33.90 Other topics in molecular spectra and interactions with photons
- 34.00 ATOMIC AND MOLECULAR COLLISION PROCESSES AND INTERACTIONS
 34.10 General theories and models
 34.20 Interatomic and intermolecular potentials and forces
 34.25 Intramolecular energy transfer; intramolecular dynamics; dynamics of van der Waals molecules
 34.30 Potential energy surfaces for collisions
 34.40 Elastic scattering of atoms and molecules
 34.50 Inelastic scattering of atoms and molecules
 34.50E *Rotational and vibrational energy transfer*
 34.50H *Electronic excitation and ionization (including beam-foil excitation and ionization)*
 34.50L *Chemical reactions, energy disposal, and angular distribution, as studied by atomic and molecular beams*
 34.70 Charge transfer
 34.80 Electron scattering, electron spectra
 34.80B *Elastic scattering of electrons by atoms and molecules*
 34.80D *Atomic excitation and ionization by electron impact*
 34.80G *Molecular excitation, ionization, and dissociation by electron impact*
 34.90 Other topics in atomic and molecular collision processes and interactions
- 35.00 PROPERTIES OF ATOMS AND MOLECULES; INSTRUMENTS AND TECHNIQUES
 35.10 Atoms
 35.10B *Atomic masses, mass spectra, abundances, and isotopes*
 35.10D *Electric and magnetic moments, polarizability*
 35.10F *Fine- and hyperfine-structure constants*
 35.10H *Ionization potentials, electron affinities*
 35.10W *Weak interactions*
 35.20 Molecules
 35.20B *General molecular conformation and symmetry; stereochemistry*
 35.20D *Interatomic distances and angles*
 35.20G *Bond strengths, dissociation energies, hydrogen bonding, etc.*
 35.20J *Barrier heights (internal rotation, inversion); rotational isomerism, conformational dynamics*
 35.20M *Electric and magnetic moments (and derivatives), polarizability, and magnetic susceptibility*
 35.20P *Rotation, vibration, and vibration-rotation constants*
 35.20S *Hyperfine- and fine-structure constants*
 35.20V *Ionization potentials, electron affinities, molecular core binding energy*
 35.20W *Weak interactions*
 35.20X *Mass spectra*
 35.20Y *Correlation times in molecular dynamics*
 35.80 Atomic and molecular measurements and techniques
- 36.00 STUDIES OF SPECIAL ATOMS AND MOLECULES
 36.10 Exotic atoms and molecules (containing mesons, muons, and other abnormal particles)
 36.20 Macromolecules and polymer molecules
 36.40 Atomic and molecular clusters
 36.90 Other special atoms and molecules
- 40.00 CLASSICAL AREAS OF PHENOMENOLOGY
 41.00 ELECTRICITY AND MAGNETISM: FIELDS AND CHARGED PARTICLES
 41.10 Classical electromagnetism
 41.10D *Electrostatics, magnetostatics*
 41.10F *Steady-state electromagnetic fields; electromagnetic induction*
 41.10H *Electromagnetic waves: theory*
 41.70 Particles in electromagnetic fields: classical aspects
 41.80 Particle beams and particle optics
 41.80D *Electron beams and electron optics*
 41.80G *Ion beams and ion optics*
 41.90 Other topics in electricity and magnetism

- 42.00 OPTICS
- 42.10 Propagation and transmission in homogeneous media
- 42.20 Propagation and transmission in inhomogeneous media
- 42.30 Optical information, image formation and analysis
- 42.40 Holography
- 42.50 Quantum optics
- 42.52 Masers
- 42.55 Lasing processes
- 42.55B *General theory of lasing action*
- 42.55D *CO₂ lasers*
- 42.55F *Inert gas lasers*
- 42.55G *Excimer lasers*
- 42.55H *Lasing action in other gas lasers*
- 42.55K *Chemical lasers*
- 42.55M *Lasing action in liquids and organic dyes*
- 42.55P *Lasing action in semiconductors with junctions*
- 42.55Q *Laser-active defect centres in solids*
- 42.55R *Lasing action in other solids*
- 42.55T *Free electron lasers*
- 42.55V *High energy lasing processes (e.g. gamma- and X-ray lasers)*
- 42.60 Laser systems and laser beam applications
- 42.60B *Design of specific laser systems*
- 42.60D *Laser resonators and cavities*
- 42.60F *Laser beam modulation*
- 42.60H *Optical problems related to properties and interactions of laser beams*
- 42.60K *Optical problems related to applications of laser beams*
- 42.65 Nonlinear optics
- 42.65C *Stimulated Raman, Brillouin, and Rayleigh scattering; parametric oscillations and harmonic generation*
- 42.65F *Phase conjugation*
- 42.65G *Photon echoes, self-induced transparency, optical saturation and related effects*
- 42.65J *Beam trapping, self focusing, thermal blooming, and related effects*
- 42.65K *Harmonic generation, frequency conversion, parametric oscillation and amplification*
- 42.65P *Optical bistability, multistability and switching*
- 42.70 Optical materials
- 42.70C *Glass*
- 42.70G *Light-sensitive materials*
- 42.72 Optical sources and standards
- 42.78 Optical lens and mirror systems
- 42.78H *Coatings*
- 42.80 Optical devices, techniques and applications
- 42.80B *Spatial filters, zone plates*
- 42.80C *Spectral and other filters*
- 42.80D *Monochromators*
- 42.80E *Shutters, windows, diaphragms, deflectors, choppers*
- 42.80F *Gratings, echelles*
- 42.80K *Optical beam modulators*
- 42.80L *Optical waveguides*
- 42.80M *Fibre optics*
- 42.80Q *Image detectors, converters, and intensifiers*
- 42.80R *Gradient-index (GRIN) devices*
- 42.80S *Optical communications devices*
- 42.80W *Ultrafast optical techniques*
- 42.81 Fibre optics and fibre waveguides
- 42.81B *Fibre fabrication, cladding, splicing, joining, etc*
- 42.81C *Fibre testing and measurement of fibre parameters*
- 42.81H *Gradient-index (GRIN) fibre devices and techniques*
- 42.81M *Fibre couplers and connectors*
- 42.81P *Fibre optic sensors; fibre gyros*
- 42.82 Integrated optics
- 42.85 Optical testing and workshop techniques
- 42.90 Other topics in optics
- 43.00 ACOUSTICS
- 43.20 General linear acoustics
- 43.25 Nonlinear acoustics and macrosonics
- 43.28 Aeroacoustics and atmospheric sound
- 43.30 Underwater sound
- 43.35 Ultrasonics, quantum acoustics, and physical effects of sound
- 43.40 Mechanical vibrations and shock
- 43.45 Statistical studies of acoustical response
- 43.50 Noise, its effects and control
- 43.55 Architectural acoustics
- 43.60 Acoustic signal processing
- 43.63 Acoustic holography
- 43.70 Speech communication
- 43.75 Music and musical instruments
- 43.85 Acoustical measurements and instrumentation
- 43.88 Transduction; devices for the generation and reproduction of sound
- 43.90 Other topics in acoustics
- 44.00 HEAT FLOW, THERMAL AND THERMODYNAMIC PROCESSES
- 44.10 Heat conduction (models, phenomenological description)
- 44.25 Convection
- 44.30 Heat transfer in inhomogeneous media and through interfaces
- 44.40 Heat radiation
- 44.50 Thermal properties of matter (phenomenology)
- 44.60 Thermodynamic processes (phenomenology)
- 44.90 Other topics in heat flow, thermal and thermodynamic processes
- 46.00 MECHANICS, ELASTICITY, RHEOLOGY
- 46.10 Mechanics of discrete systems
- 46.20 Continuum mechanics
- 46.30 Mechanics of solids
- 46.30C *Elasticity*
- 46.30J *Viscoelasticity, plasticity, viscoplasticity, creep, and stress relaxation*
- 46.30L *Buckling and instability*
- 46.30M *Vibrations, aeroelasticity, hydroelasticity, mechanical waves, and shocks*
- 46.30N *Fracture mechanics, fatigue, and cracks*
- 46.30P *Friction, wear, adherence, hardness, mechanical contacts*
- 46.30R *Measurement methods and techniques*
- 46.60 Rheology of fluids and pastes
- 46.90 Other topics in mechanics, elasticity, and rheology
- 47.00 FLUID DYNAMICS
- 47.10 General theory
- 47.15 Laminar flows
- 47.15C *Laminar boundary layers*
- 47.15F *Stability of laminar flows*
- 47.20 Hydrodynamic stability and instability
- 47.25 Turbulent flows, convection, and heat transfer
- 47.25C *Isotropic turbulence*
- 47.25F *Boundary layer and shear turbulence*
- 47.25J *Turbulent diffusion*

- 47.25M *Noise (turbulence generated)*
 47.25Q *Convection and heat transfer*
 47.25R *Wakes*
 47.30 Rotational flow and vorticity
 47.35 Waves
 47.40 Compressible flows; shock and detonation phenomena
 47.40D *General subsonic flows*
 47.40H *Transonic flows*
 47.40K *Supersonic and hypersonic flows*
 47.40N *Shock-wave interactions*
 47.45 Rarefied gas dynamics
 47.50 Non-newtonian dynamics
 47.55 Nonhomogeneous flows
 47.55B *Cavitation*
 47.55C *Jets*
 47.55E *Nozzles*
 47.55H *Stratified flows*
 47.55K *Multiphase flows*
 47.55M *Flow through porous media*
 47.60 Flows in ducts, channels, and conduits
 47.65 Magnetohydrodynamics and electrohydrodynamics
 47.70 Reactive, radiative, or nonequilibrium flows
 47.75 Relativistic fluid dynamics
 47.80 Instrumentation for fluid dynamics
 47.90 Other topics in fluid dynamics
- 50.00 **FLUIDS, PLASMAS AND ELECTRIC DISCHARGES**
- 51.00 KINETIC AND TRANSPORT THEORY OF FLUIDS;
 PHYSICAL PROPERTIES OF GASES
 51.10 Kinetic and transport theory
 51.20 Viscosity and diffusion: experimental
 51.30 Thermal properties of gases
 51.40 Acoustical properties of gases; ultrasonic relaxation
 51.50 Electrical phenomena in gases
 51.60 Magnetic phenomena in gases
 51.70 Optical phenomena in gases
 51.90 Other topics in the physics of fluids
- 52.00 THE PHYSICS OF PLASMAS AND ELECTRIC
 DISCHARGES
 52.20 Elementary processes in plasma
 52.20F *Electron collisions*
 52.20H *Atomic, molecular, heavy-particle collisions*
 52.25 Plasma: basic properties
 52.25F *Transport properties*
 52.25P *Emission, absorption and scattering of radiation*
 52.30 Plasma flow; magnetohydrodynamics
 52.35 Waves, oscillations, and instabilities in plasma
 52.35R *Plasma turbulence*
 52.35T *Shock waves*
 52.40 Plasma interactions
 52.40D *Electromagnetic wave propagation in plasma*
 52.40F *Antennas in plasma; plasma-filled wave guides*
 52.40H *Solid-plasma interactions*
 52.40K *Sheaths*
 52.40M *Particle beam interactions in plasma*
 52.50 Plasma production and heating
 52.50J *Plasma production and heating by laser beams*
 52.50L *Plasma production and heating by shock wave and wire explosion*
 52.55 Plasma equilibrium and confinement
 52.60 Relativistic plasma
- 52.65 Plasma simulation
 52.70 Plasma diagnostic techniques and instrumentation
 52.75 Plasma devices and applications
 52.80 Electric discharges
 52.90 Other topics in plasma physics and electric discharges
- 60.00 **CONDENSED MATTER: STRUCTURE, THERMAL
 AND MECHANICAL PROPERTIES**
- 61.00 STRUCTURE OF LIQUIDS AND SOLIDS;
 CRYSTALLOGRAPHY
 61.10 X-ray determination of structures
 61.10D *Theories of diffraction and scattering*
 61.10F *Experimental techniques*
 61.12 Neutron determination of structures
 61.12B *Theories of diffraction and scattering*
 61.12E *Neutron scattering techniques*
 61.12G *Neutron diffraction techniques*
 61.14 Electron determination of structures
 61.14D *Theories of diffraction and scattering*
 61.14F *Experimental diffraction and scattering*
 61.14H *Low-energy electron diffraction (LEED) and reflection high-energy electron diffraction (RHEED)*
 61.16 Other determination of structures
 61.16D *Electron microscopy determinations*
 61.16F *Field-ion microscopy determinations*
 61.16N *EPR and NMR determinations*
 61.20 Classical, semiclassical, and quantum theories of liquid structure
 61.25 Studies of specific liquid structures
 61.25M *Liquid metals*
 61.30 Liquid crystals
 61.40 Amorphous and polymeric materials
 61.40D *Glasses*
 61.40K *Polymers, elastomers, and plastics*
 61.50 Crystalline state
 61.50C *Physics of crystal growth*
 61.50E *Crystal symmetry; models and space groups, and crystalline systems and classes*
 61.50J *Crystal morphology and orientation*
 61.50K *Crystallographic aspects of polymorphic and order-disorder transformations*
 61.50L *Crystal binding*
 61.55 Specific structure of elements and alloys
 61.55D *Nonmetallic elements*
 61.55F *Metallic elements*
 61.55H *Alloys*
 61.60 Specific structure of inorganic compounds
 61.65 Specific structure of organic compounds
 61.70 Defects in crystals
 61.70B *Interstitials and vacancies*
 61.70D *Colour centres*
 61.70E *Other point defects*
 61.70G *Dislocations: theory*
 61.70J *Etch pits, decoration, transmission electron-microscopy and other direct observations of dislocations*
 61.70L *Slip, creep, internal friction and other indirect evidence of dislocations*
 61.70N *Grain and twin boundaries*
 61.70P *Stacking faults, stacking fault tetrahedra and other planar or extended defects*
 61.70Q *Liquid and gas inclusions*
 61.70R *Crystal impurities: general*

- 61.70T *Doping and implantations of impurities*
 61.70W *Impurity concentrations, distribution, and gradients*
 61.70Y *Interaction between different crystal structure defects*
 61.80 Radiation damage and other irradiation effects
 61.80B *Laser beams*
 61.80C *X-rays*
 61.80E *Gamma rays*
 61.80F *Electrons and positrons*
 61.80H *Neutrons*
 61.80J *Ions*
 61.80L *Atoms and molecules*
 61.80M *Channeling, blocking and energy loss of particles*
 61.90 Other topics in structure of liquids and solids
- 62.00 **MECHANICAL AND ACOUSTIC PROPERTIES OF CONDENSED MATTER**
 62.10 Mechanical properties of liquids
 62.20 Mechanical properties of solids (related to microscopic structure)
 62.20D *Elastic constants*
 62.20F *Deformation and plasticity*
 62.20H *Creep*
 62.20M *Fatigue, brittleness, fracture, and cracks*
 62.20P *Tribology*
 62.30 Mechanical and elastic waves
 62.40 Anelasticity, internal friction, and damping
 62.50 High-pressure and shock-wave effects in solids
 62.60 Acoustic properties of liquids
 62.65 Acoustic properties of solids
 62.80 Ultrasonic relaxation
 62.90 Other topics in mechanical and acoustical properties of condensed matter
- 63.00 **LATTICE DYNAMICS AND CRYSTAL STATISTICS**
 63.10 General theory
 63.20 Phonons and vibrations in crystal lattices
 63.20D *Phonon states and bands, normal modes, and phonon dispersion*
 63.20H *Phonon-phonon interactions*
 63.20K *Phonon-electron interactions*
 63.20L *Phonon interactions with quasi-particles*
 63.20M *Phonon-defect interactions*
 63.20P *Localized modes*
 63.20R *Anharmonic lattice modes*
 63.50 Vibrational states in disordered systems
 63.70 Statistical mechanics of lattice vibrations
 63.75 Statistical mechanics of displacive phase-transitions
 63.90 Other topics in lattice dynamics and crystal statistics
- 64.00 **EQUATIONS OF STATE, PHASE EQUILIBRIA, AND PHASE TRANSITIONS**
 64.10 General theory of equations of state and phase equilibria
 64.30 Equations of state of specific substances
 64.60 General studies of phase transitions
 64.70 Phase equilibria, phase transitions, and critical points
 64.70D *Solid-liquid transitions*
 64.70F *Liquid-vapour transitions*
 64.70H *Solid-vapour transitions*
 64.70J *Liquid-liquid transitions*
 64.70K *Solid-solid transitions*
 64.70M *Transitions in liquid crystals*
 64.70P *Glass transitions*
 64.70R *Commensurate-incommensurate transitions*
 64.75 Solubility, segregation, and mixing
- 64.80 Other phase properties of systems
 64.90 Other topics in equations of state, phase equilibria, and phase transitions
- 65.00 **THERMAL PROPERTIES OF CONDENSED MATTER**
 65.20 Heat capacities of liquids
 65.40 Heat capacities of solids
 65.50 Thermodynamic properties and entropy
 65.70 Thermal expansion and thermomechanical effects
 65.90 Other topics in thermal properties of condensed matter
- 66.00 **TRANSPORT PROPERTIES OF CONDENSED MATTER (NONELECTRONIC)**
 66.10 Diffusion and ionic conduction in liquids
 66.20 Diffusive momentum transport
 66.30 Diffusion in solids
 66.30D *Theory of diffusion and ionic conduction in solids*
 66.30F *Self-diffusion in metals, semimetals, and alloys*
 66.30H *Self-diffusion and ionic conduction in nonmetals*
 66.30J *Diffusion, migration, and displacement of impurities*
 66.30L *Diffusion, migration, and displacement of other defects*
 66.30N *Chemical interdiffusion*
 66.30Q *Electromigration*
 66.60 Thermal conduction in nonmetallic liquids
 66.70 Nonelectronic thermal conduction and heat-pulse propagation in nonmetallic solids
 66.90 Other topics in nonelectronic transport properties
- 67.00 **QUANTUM FLUIDS AND SOLIDS; LIQUID AND SOLID HELIUM**
 67.20 Quantum effects on the structure and dynamics of non-degenerate fluids
 67.40 Boson degeneracy and superfluidity of helium-4
 67.50 Fermi fluids; liquid helium-3
 67.60 Mixed systems; liquid helium 3-4 mixtures
 67.65 Spin-polarized hydrogen and helium
 67.70 Films
 67.80 Solid helium and related quantum crystals
 67.90 Other topics in quantum fluids and solids (e.g. neutron-star matter)
- 68.00 **SURFACES AND INTERFACES; THIN FILMS AND WHISKERS**
 68.10 Fluid surfaces and interfaces with fluids
 68.15 Liquid thin films
 68.20 Solid surface structure
 68.22 Surface diffusion, segregation and interfacial compound formation
 68.25 Mechanical and acoustical properties of solid surfaces and interfaces
 68.30 Dynamics of solid surfaces and interface vibrations
 68.40 Surface energy of solids; thermodynamic properties
 68.42 Surface phase transitions and critical phenomena
 68.45 Solid-fluid interface processes
 68.48 Solid-solid interfaces
 68.55 Thin film growth, structure, and epitaxy
 68.60 Physical properties of thin films, nonelectronic
 68.65 Layer structures, intercalation compounds and superlattices: growth, structure and nonelectronic properties
 68.70 Whiskers and dendrites: growth, structure, and non-electronic properties
 68.90 Other topics in the structure and nonelectronic properties of surfaces and thin films

- 70.00 **CONDENSED MATTER: ELECTRONIC STRUCTURE, ELECTRICAL, MAGNETIC, AND OPTICAL PROPERTIES**
- 71.00 **ELECTRON STATES**
- 71.10 General theories and computational techniques
- 71.20 Electronic density of states determinations
- 71.25 Nonlocalized single-particle electronic states
- 71.25C *Techniques of band-structure calculation (general theory, applications of group theory, analytic continuation, etc.)*
- 71.25H *Measurement of Fermi surface parameters*
- 71.25J *Effective mass and g-factors*
- 71.25L *Electron energy states in liquid metals*
- 71.25M *Electron energy states in amorphous and glassy solids*
- 71.25P *Band structure of crystalline metals*
- 71.25R *Band structure of crystalline elemental semiconductors*
- 71.25T *Band structure of crystalline semiconductor compounds and insulators*
- 71.28 Narrow-band systems, heavy-fermion metals; intermediate-valence solids
- 71.30 Metal-insulator transitions
- 71.35 Excitons and related phenomena
- 71.36 Polaritons
- 71.38 Polarons and electron-phonon interactions
- 71.45 Collective effects
- 71.45G *Exchange, correlation, dielectric and magnetic functions, plasmons*
- 71.45J *Fermi-Thomas model*
- 71.45L *Charge-density-wave systems*
- 71.45N *Calculations of total electronic binding energy*
- 71.50 Localized single-particle electronic states
- 71.55 Impurity and defect levels
- 71.55J *Localization in disordered structures*
- 71.65 Positron states
- 71.70 Level splitting and interactions
- 71.70C *Crystal and ligand fields*
- 71.70E *Spin-orbit coupling, Zeeman, Stark, and strain splitting*
- 71.70G *Exchange interactions*
- 71.70J *Nuclear states and interactions*
- 71.70M *Other bulk localized states*
- 71.90 Other topics in electron states
- 72.00 **ELECTRONIC TRANSPORT IN CONDENSED MATTER**
- 72.10 Theory of electronic transport; scattering mechanisms
- 72.15 Electronic conduction in metals and alloys
- 72.15C *Electrical and thermal conduction in amorphous and liquid metals and alloys*
- 72.15E *Electrical and thermal conduction in crystalline metals and alloys*
- 72.15G *Galvanomagnetic and other magnetotransport effects*
- 72.15H *Thermomagnetic effects*
- 72.15J *Thermoelectric effects*
- 72.15L *Relaxation times and mean free paths*
- 72.15N *Collective modes; low-dimensional conductors*
- 72.15Q *Scattering mechanism* and Kondo effect*
- 72.15R *Quantum localization*
- 72.20 Conductivity phenomena in semiconductors and insulators
- 72.20D *General theory, scattering mechanisms*
- 72.20F *Low-field transport and mobility; piezoresistance*
- 72.20H *High-field and nonlinear effects*
- 72.20J *Charge carriers; generation, recombination, lifetime, and trapping*
- 72.20M *Galvanomagnetic and other magnetotransport effects*
- 72.20N *Thermomagnetic effects*
- 72.20P *Thermoelectric effects*
- 72.30 High-frequency effects; plasma effects
- 72.40 Photoconduction and photovoltaic effects; photodielectric effects
- 72.50 Acoustoelectric effects
- 72.55 Magnetoacoustic effects
- 72.60 Mixed conductivity and conductivity transitions
- 72.70 Noise processes and phenomena
- 72.80 Conductivity of specific semiconductors and insulators
- 72.80C *Elemental semiconductors*
- 72.80E *III-V and II-VI semiconductors*
- 72.80G *Transition-metal compounds*
- 72.80J *Other crystalline inorganic semiconductors*
- 72.80L *Organic semiconductors*
- 72.80N *Amorphous and glassy semiconductors*
- 72.80P *Liquid semiconductors*
- 72.90 Other topics in electronic transport in condensed matter
- 73.00 **ELECTRONIC STRUCTURE AND ELECTRICAL PROPERTIES OF SURFACES, INTERFACES, AND THIN FILMS**
- 73.20 Electronic surface states
- 73.25 Surface conductivity and carrier phenomena
- 73.30 Surface double layers, Schottky barriers, and work functions
- 73.40 Interfaces
- 73.40B *Static electrification*
- 73.40G *Tunnelling: general*
- 73.40J *Metal-to-metal contacts*
- 73.40L *Semiconductor-to-semiconductor contacts, p-n junctions, and heterojunctions*
- 73.40M *Semiconductor-electrolyte contacts*
- 73.40N *Metal-nonmetal contacts*
- 73.40Q *Metal-insulator-semiconductor structures*
- 73.40R *Metal-insulator-metal structures*
- 73.40S *Metal-semiconductor-metal structures*
- 73.40T *Semiconductor-insulator-semiconductor structures*
- 73.40V *Semiconductor-metal-semiconductor structures*
- 73.60 Electronic properties of thin films
- 73.60D *Metallic thin films*
- 73.60F *Semiconductor films*
- 73.60H *Insulating thin films*
- 73.90 Other topics in electrical properties of surfaces, interfaces, and thin films
- 74.00 **SUPERCONDUCTIVITY**
- 74.10 Occurrence, critical temperature
- 74.20 Theory
- 74.20F *BCS theory and its application*
- 74.30 General properties
- 74.30C *Magnetization curves, Meissner effect, penetration depth*
- 74.30E *Thermodynamic properties; thermal conductivity*
- 74.30G *Response to electromagnetic fields, nuclear magnetic resonance, ultrasonic attenuation*
- 74.40 Fluctuations and critical effects
- 74.50 Proximity effects, tunnelling phenomena, and Josephson effect
- 74.55 Type-I superconductivity
- 74.60 Type-II superconductivity
- 74.60E *Mixed state, H_{c2} surface sheath*
- 74.60G *Flux pinning, flux motion fluxon-defect interactions*
- 74.60J *Critical currents*
- 74.60M *Material effect on T_c, K, critical currents*
- 74.65 Insulator-superconductor transition

- 74.70 Superconducting materials
 74.70B Elemental superconductors
 74.70C Al₅ compounds and alloys
 74.70E Interstitial compounds and alloys
 74.70F Chevrel phase (ternary molybdenum chalcogenide) superconductors
 74.70H Magnetic superconductors
 74.70J Superconducting layer structures and intercalation compounds
 74.70K Organic superconductors
 74.70M Amorphous, highly disordered, and granular superconductors
 74.70Q Laves phase (C15) superconductors
 74.70S Superconducting metastable nonstoichiometric phases
 74.70T Heavy-fermion superconductors
 74.70V Perovskite phase superconductors
 74.70Y Other superconducting materials
 74.75 Superconducting films
 74.90 Other topics in superconductivity
- 75.00 MAGNETIC PROPERTIES AND MATERIALS
 75.10 General theory and models of magnetic ordering
 75.10D Crystal-field theory and spin Hamiltonians
 75.10H Ising and other classical spin models
 75.10J Heisenberg and other quantized localized spin models
 75.10L Band and itinerant models
 75.10N Spin-glass models
 75.20 Diamagnetism and paramagnetism
 75.20C Nonmetals
 75.20E Metals and alloys
 75.20H Local moments in dilute alloys; Kondo effect, valence fluctuations, heavy fermions
 75.25 Spin arrangements in magnetically ordered materials (neutron studies, etc.)
 75.30 Magnetically ordered materials, other intrinsic properties
 75.30C Saturation moments and magnetic susceptibility
 75.30D Spin waves
 75.30E Exchange and superexchange interactions
 75.30F Spin-density waves
 75.30G Anisotropy
 75.30H Magnetic impurity interactions
 75.30K Magnetic phase boundaries
 75.30M Valence fluctuations, Kondo lattice and heavy fermions
 75.30S Magnetocaloric effect
 75.30T Surface magnetism
 75.40 Critical-point effects, specific heats, short-range order
 75.40C Static properties
 75.40G Dynamic properties
 75.40M Numerical simulation studies
 75.50 Studies of specific magnetic materials
 75.50B Ferromagnetism of Fe and its alloys
 75.50C Ferromagnetism of other metals
 75.50D Ferromagnetism of nonmetals
 75.50E Antiferromagnetics
 75.50G Ferrimagnetics
 75.50K Amorphous magnetic materials
 75.50L Spin glasses
 75.50M Magnetic liquids
 75.50P Magnetic semiconductors
 75.50R Magnetism in interface structures
 75.60 Domain effects, magnetization curves, and hysteresis
 75.60C Domain walls and domain structure
 75.60E Magnetization curves, hysteresis, Barkhausen and related effects
 75.60G High coercivity materials
 75.60J Fine-particle systems
 75.60L Magnetic aftereffects
 75.60N Magnetic annealing and temperature-hysteresis effects
 75.70 Magnetic films and multilayers
 75.70K Domain structure (magnetic bubbles)
 75.80 Magnetomechanical and magnetoelectric effects, magnetostriction
 75.90 Other topics in magnetic properties and materials
- 76.00 MAGNETIC RESONANCES AND RELAXATION IN CONDENSED MATTER; MÖSSBAUER EFFECT
 76.20 General theory of resonances and relaxation
 76.30 Electron paramagnetic resonance and relaxation
 76.30D Ions and impurities: general
 76.30F Iron group (3d) ions and impurities (Ti-Cu)
 76.30H Platinum and palladium group (4d and 5d) ions and impurities (Zr-Ag and Hf-Au)
 76.30K Rare-earth ions and impurities
 76.30L Other ions and impurities
 76.30M Colour centres and other defects
 76.30P Conduction electrons
 76.30R Free radicals
 76.40 Diamagnetic and cyclotron resonances
 76.50 Ferromagnetic, antiferromagnetic, and ferrimagnetic resonances; spin wave resonance
 76.60 Nuclear magnetic resonance and relaxation
 76.60C Chemical and Knight shifts
 76.60E Relaxation effects
 76.60G Quadrupole resonance
 76.60L Spin echoes
 76.70 Magnetic double resonances and cross effects
 76.70D Electron-nuclear double resonance (ENDOR)
 76.70E Dynamical nuclear polarization
 76.70F Double nuclear magnetic resonance (DNMR)
 76.70H Optical double magnetic resonance (ODMR)
 76.70K Electron double resonance (ELDOR)
 76.75 Muon spin rotation and relaxation
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